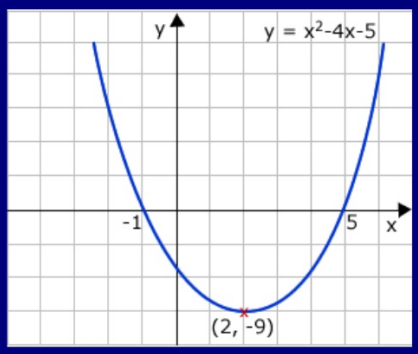
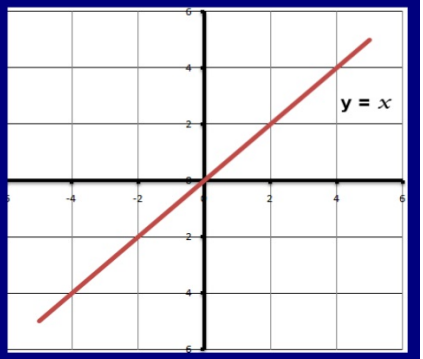
Linear and Nonlinear Functions

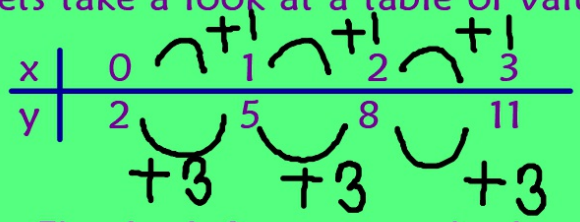
Objective: To identify and represent linear and nonlinear functions.





Linear Function- Writing the equation from the table of values

Lets take a look at a table of values of a linear function



1. First look for patterns in the x-values and y-values.
   Is there a constant change in both the x-values and the y-values?
   Change in x +1
   Change in y +3

*Remember to find the rate of change write the ratio $\frac{\text{change in y}}{\text{change in x}}$.

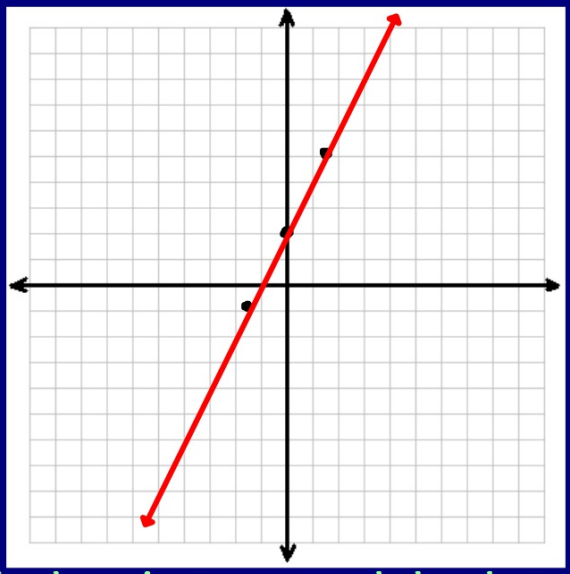
2. See if you can identify the y-intercept from the table of values.
   y-intercept (b) 2
   *Remember the y-intercept is the value of y when x=0.

3. Write the equation in slope-intercept form y=mx + b.
   Equation: y=3x+2

Linear Functions - Writing the equation from the graph

x	0	1	2	3
y	2	5	8	11

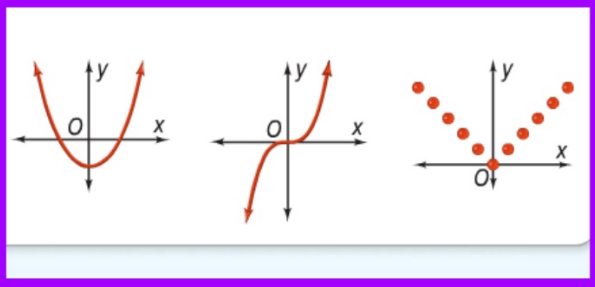
1. Graph the points from the table on the coordinate plane.



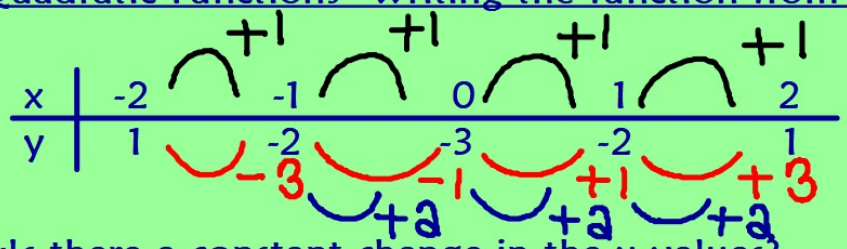
2. Identify the y-intercept and the slope from the graph and write the equation.

Just like linear functions, nonlinear functions can be represented using words, tables, equations, sets of ordered pairs, and graphs.

A nonlinear function is a function whose graph is not a line or a part of a line.



Quadratic Functions- Writing the function from a table of values.



1. Is there a constant change in the x-values?

yes, +1.

2. Find the change in the y-values.
   If the change is constant the table represents a linear function.

   If it is not linear then repeat step 2.

   Is there constant change? yes, +2.

   *The number of times step 2 is repeated to find a constant change in y determines the degree of the function.

3. Identify the y-intercept and then write the function.

$y = x^2 - 3$

Quadratic Function - Writing the equation from the graph

x	-2	-1	0	1	2
y	1	-2	-3	-2	1

1. Check for a constant change in the x-values and y-values to determine if the function is linear, quadratic or neither.

2. On the calculator enter the data in stat list and calculate the equation.

   If linear use stat - calc - 4:LinReg - enter

   If quadratic use stat - calc - 5: QuadReg - enter

Exponential Function: Writing the equation from a table of values

x	0	1	2	3
y	1	2	4	8

+1 +1 +1

+1 +2 +4

+1 +2

1. Look for a pattern in the table of values.

   Does x have a constant change, if yes what? +1

   Does y have a constant change, if no check for a constant ratio.
   What is the constant change or ratio? r = 2

2. If y has a constant ratio, then the function is exponential and the common ratio is the base of the function.

   Write the function: $y = 1 \cdot 2^x$ or $y = 2^x$

$y = a \cdot b^x$

a → y-int. b → Ratio

Exponential Functions: Writing the equation from a graphing calculator

x	0	1	2	3
y	1	2	4	8

1. Look for patterns in the x and y-values of the table.

- If x and y have a constant rate of change the first time the function is linear.
- If the x values have a constant rate of change and you find y has a constant rate the 2nd time the function is quadratic.
- If the x values have a constant rate of change and the y-values have a constant ration the function is exponential.

2. On the calculator enter the data in stat list and calculate the equation.

If linear use stat - calc - 4:LinReg - enter
If quadratic use stat - calc - 5: QuadReg - enter
If exponential use stat - calc - 0:ExpReg - enter

You Try: Write the equation of the function.

1.

x	-1	0	1	2	3
y	-1	2	5	8	11

+1 +1 +1 +1

+3 +3 +3 +3

linear

$y = 3x + 2$

2.

x	0	1	2	3	4
y	1	3	9	27	81

+1 +1 +1 +1

+2 +6 +18 +54

+4 +12 +36

exponential

$y = 3^x$

3.

x	-2	-1	0	1	2
y	13	4	1	4	13

+1 +1 +1 +1

-9 -3 +3 +9

+6 +6 +6

quadratic

$y = 3x^2 + 1$

Assignment:

In partners cut and paste the matching graphs, equations, and tables on construction paper.